CLINICAL DECISION-MAKING

FOR CARIES MANAGEMENT IN PRIMARY TEETH

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ABSTRACT

The aim of this review of clinical decision-making for caries management in primary teeth is to integrate current knowledge in the field of cariology into clinically usable concepts and procedures to aid in the diagnosis and therapy of dental caries in primary teeth. The evidence for this paper is derived from other manuscripts of this conference; computer and hand searches of scientific articles; and policy statements of councils or commissions of various health organizations. Current evidence regarding the carious process and caries risk assessment allows the practitioner to transcend traditional surgical management of dental caries in primary teeth. Therapy can focus on patient-specific approaches that include disease monitoring and preventive therapies supplemented by restorative therapies. The type and intensity of these therapies should be determined utilizing data from clinical and radiograph examinations as well as information regarding caries risk status; evidence of therapy outcomes; assessment and reassessment of disease activity; natural history of caries progression in primary teeth; and preferences and expectations of guardians and practitioners. Changes in the management of dental caries will require health organizations and dental schools to educate students, practitioners and patients in evidence- and risk-based care.

Key words: Dental caries, evidence-based practice, primary teeth, risk assessment, decision making

INTRODUCTION

Historically, management of dental caries in primary and permanent teeth has involved clinical and radiographic identification of carious lesions followed by surgical intervention to remove and restore affected enamel and dentin. Only modest changes over the years have occurred in this surgical approach to dental caries treatment. However, sufficient evidence exists to recommend that dental therapy needs to address this disease both by fostering remineralization as well as restoring teeth. Appropriate dental care in a child requires an understanding of the carious process that includes patient's age, caries risk, prior therapy outcomes, location and extent of the lesions (Figure). In this model, a child who has been identified as being at low risk for dental caries may need few diagnostic procedures and preventive therapies. Conversely, a child that is caries active may require frequent diagnostic procedures and preventive therapies.

METHODS

The aim of this review was to integrate current knowledge in the field of cariology into clinically usable procedures to aid in the diagnosis, clinical decision-making and therapy of dental caries in primary teeth. The scientific literature for this paper is derived from evidence-based reviews from the other manuscripts of this Consensus Development Conference, computer and hand searches of scientific articles, and guidelines and policy statements of councils or commissions of various health organizations that may be related to primary teeth.

Scientific articles related to the primary dentition were searched on MEDLINE, PubMed and Cochrane from 1966 to 2000. The searches were limited to articles written in English that included human subjects from birth to age twelve years. The searches using the term "dental caries," limited by the terms “primary,” “deciduous” or “mixed,” identified 1,039 articles. These articles were reviewed by title and then abstract resulting in 118 references related to caries diagnosis, progression, prevention and restorative treatment in primary teeth. Hand searching of reference lists in these articles also supplemented the electronic literature searches. Further reduction in the number of papers to be included in this review was done after the manuscripts were read in full.

FACTORS IN DECISION MAKING

Primary Teeth

The vast majority of the literature regarding diagnosis and prevention of caries relates to permanent teeth. Although much of this information may be extrapolated to primary teeth, there are important differences between primary and permanent teeth that may affect diagnosis, caries risk and therapy for primary teeth. Most importantly, primary teeth have thinner enamel and dentin and broader proximal contacts than permanent teeth (1) leading to increased caries susceptibility and more rapid progression of caries to the pulp.

Natural History Of Caries In The Primary Dentition

A unique feature regarding caries management of primary teeth is that a child’s age is an important factor with regard to caries initiation and progression. The age at which a child becomes colonized with the cariogenic bacterial group, mutans streptococci, is a critical factor for caries risk (2,3). Mutans streptococci are believed to be particularly caries conducive because of their ability to adhere to tooth surfaces, to produce copious amounts of acid, and to survive and continue metabolism at low pH conditions (4). Permanent colonization of a child’s oral cavity with mutans streptococci can occur only after tooth eruption because mutans streptococci requires a non-shedding surface for attachment (5). Such colonization is generally the result of transmission of these organisms from the child’s primary care giver, usually the mother (6).

Those teeth that are first exposed to a cariogenic environment generally will be the first to show signs of disease. Consequently, children at high risk for early childhood caries may develop lesions on their maxillary anterior teeth soon after eruption (7). If these children continue to be at high risk, they may develop fissure caries of the primary molars and later molar proximal caries (8). Children with moderate caries risk may develop caries at a later age, normally fissure caries and possibly molar proximal caries (7,9). In general, caries on maxillary anterior primary teeth and on the molar proximal surfaces suggest high caries activity.

At the individual lesion level, caries progression and appropriate therapy is dependent on the site of the lesion, level of risk and disease activity, as well as age. Buccal-lingual smooth surface lesions, even if cavitated, may be readily amenable to preventive regimens, while cavitated fissure or cavitated proximal lesions may need restorative therapy to limit progression. Caries activity can be assessed by observing the speed of progression of existing lesions or the incidence of new lesions.

Five articles were located that examined caries progression of proximal lesions in primary teeth (Table 1). Even though four are confounded by the presence of preventive regimes, results are similar among studies with 73% to 81% of lesions remaining in enamel after 12 months. In the fifth study, proximal lesion progression through primary tooth enamel in high-risk subjects not receiving fluoride took approximately 18 months. In low risk children receiving regular topical fluoride therapy, progression took 42 months (12). These collective findings suggest that detection of enamel proximal lesions on bitewing radiographs may not warrant immediate surgical intervention for all children. Many of these lesions will remain in enamel for at least 12 months, giving time for implementation and evaluation of preventive interventions without jeopardizing the integrity of the tooth.

Diagnosis

Currently, decisions for therapy often are based on whether a tooth is diagnosed as cavitated by clinical or radiographic examination. The accuracy of correctly identifying fissure caries in permanent teeth by visual and tactile methods is in question (15). However, only one article was located that addressed the validity of the diagnosis of fissure caries in primary teeth (16). Visual identification without the use of an explorer was reported to have a sensitivity of 0.45 and specificity of 1.00. Interestingly, bitewing radiographs identified dentin caries originating in fissures with a sensitivity of 0.93 and a specificity of 0.89.

Three articles were located that examined the validity of radiographic proximal caries diagnosis in primary teeth. The majority of enamel lesions detected on radiograph are not cavitated and are not detectable clinically (17); and in conflict with traditional understanding, many radiographically detected outer dentin lesions in primary teeth also may not be cavitated (Table 2).

Newer and more sensitive methods of clinical caries diagnosis appear promising, yet at this time there is little evidence of the validity and reliability of these new approaches from human clinical trials (21). Contrary to new technologies, practicing dentists can obtain feedback on false positive and false negative diagnoses when they instrument a tooth. If a surgical intervention is justified on questionable lesions in a child, the tooth most likely to be carious may be opened and the diagnosis confirmed. This technique can determine whether interventions on other teeth are needed (22).

In addition to determining whether a tooth is cavitated or not, caries diagnosis should attempt to estimate the more critical issue -- whether a lesion is progressing or arrested. Currently, longitudinal evaluation of lesion progression at periodic recall visits is the best method to determine lesion activity and progression. Along with other information, such as the likelihood of a patient returning for periodic recalls and depth of a lesion, an active carious lesion may require preventive and restorative therapy, whereas non-active or arrested lesions may require no therapy. Such patient- and tooth-specific evaluations of caries diagnosis and progression will require changes from current practice since longitudinal information has been reported to not change dentists' decision-making process (23).

Caries Risk Assessment In Primary Teeth

The goal of caries risk assessment in dentistry is to deliver preventive and restorative care specific to an individual patient. An obstacle in current caries risk assessment is that few studies have attempted to determine how the application of risk indicators in dental practice affects dental health outcomes (24). Presently, the best caries risk indicator is previous carious experience; yet, there is not one predictor or combination of predictors that have achieved high combinations of both positive and negative predictive values (24).

In young children, the risk indicator, previous caries experience, is not particularly useful since it is important to determine caries risk before disease is manifest. Low birth weight of a child has been suggested as a caries risk indicator for primary teeth, either because it is associated with enamel hypoplasia and other enamel defects, or indirectly because it is marker for low socioeconomic situations (25). Other caries risk indicators that have shown promise in preschool children are: the age that a child becomes colonized with cariogenic flora (2,3,26,27); the child's mutans streptococci levels (28,29); baseline caries scores (30,31); presence of visible plaque on the maxillary anterior teeth (32); and sociodemographic factors, such as education and income of parents (33). Even though systemic and topical fluoride exposure, tooth brushing behavior, bottle use and diet currently have not been shown to be good caries risk indicators for primary teeth, collection of such data may be valuable for development of a child's prevention program.

Besides determining caries risk at screening or initiation of therapy, ongoing reassessment of a child's caries risk at recall visits allows for better appraisal of caries activity and refinement of decisions. If at a recall visit, existing lesions have not progressed and new lesions are not detected, caries activity may be considered to have decreased. If there are increased numbers of new lesions detected, or there are changes in the oral environment (e.g., appliance therapy, increase in mutans streptococci levels, increased frequency of sucrose consumption), risk status may have increased.

<u>Parent and Practitioner Preferences</u>

The responsible parent(s), with the advice of the dental professional, is the one who must make decisions for dental therapy. In many cases, as a result of their past experiences, the parent assumes that only surgical techniques can treat dental caries. The dental professional is obliged to inform the parent about alternative therapies based on scientific evidence, risk assessment, expected outcomes and cost. Enabling the parent to be active participants in choosing preventive and restorative therapies should produce better parent and patient compliance (34).

Besides the obligation of thorough informed consent for therapy decisions, a dental professional may by training, capability or preferences favor certain therapeutic approaches. Such preferences also need to be considered in therapy decisions because provider preferences will affect outcomes. These preferences should change over time as a result of scientific progress, and the practitioners' continued learning and self-evaluation of outcomes.

PREVENTIVE THERAPIES

<u>Fluoride</u>

Daily systemic/topical fluoride exposure through optimizing the fluoride content of water supplies, historically, has been shown to be efficacious in reducing dental caries, with reductions in the range of 40-50% for primary teeth (35). The expansion of water fluoridation as well as the widespread consumption of processed beverages and foods prepared with fluoridated water by individuals in non-fluoridated areas has produced a "halo effect" in which the benefits of fluoride extend beyond the geographically fluoridated areas, thus reducing differences in caries rates between fluoridated and non-fluoridated communities (36).

If the fluoride content of water is sub-optimal or unknown, the drinking water can be analyzed for fluoride content and systemic fluoride supplementation can be recommended considering water fluoride content and child's age (37,38,39). Data from over 20 clinical trials show caries reduction in primary teeth of 30-80% from fluoride supplements, provided that they are started near birth and continued for five or more years (40,41,42,43,44). However, there is a growing body of literature showing that children, whether living in a fluoridated or non-fluoridated area, ingest sufficient quantities of fluoride from dentifrice, beverages and foods (45); and there is a strong association of dental fluorosis in the permanent teeth with fluoride supplement use (46,47). Perhaps fluoride supplements only should be prescribed to children from non-fluoridated communities, who are identified as being at moderate or high caries risk (48), and whose parents understand the risks and benefits of fluoride supplements.

The most widely used method of applying fluoride topically is by means of dentifrice. Daily/twice daily fluoride exposure through the controlled use of fluoridated dentifrice is now considered a major approach to the reduction of dental caries (49). To prevent fluorosis from the swallowing of toothpaste (47), children's brushing should be supervised with only a "pea-sized" amount dispensed onto the brush (39,48). Reduced fluoride concentrations of toothpastes also have been suggested as a method of reducing fluorosis, but there is evidence for lower efficacy when the fluoride content of the toothpastes is reduced (43).

Professional topical fluoride therapies, home fluoride mouth rinses and concentrated tray/brush-on therapies have had a long history of use to prevent dental caries (50). However, few contemporary studies have been conducted that examine the effect of professional topical and home fluoride protocols on caries reduction in primary teeth. Recently, fluoride varnishes, which are safe and easy to apply in young children, have gained popularity. Yet, their efficacy is not entirely clear, with only approximately half of the studies carried out in the primary dentition showing significant reductions in caries levels (Table 3). Except for recommending regular use of fluoridated dentifrices, professionally applied and home-use fluoride products should be recommended based on a child's caries risk.

Antimicrobial Agents

There is limited data regarding the use of antimicrobials to reduce mutans streptococci and dental caries in the permanent dentition (57). There are even fewer clinical trials in primary teeth (58,59). An interesting alternative approach, however, is the report of using chlorhexidine to suppress mutans streptococci levels in mothers, with the aim of delaying the transmission of mutans streptococci and caries in their children. The results of such a method found that infants of mothers who used chlorhexidine had a lower colonization of mutans streptococci than controls (11% vs. 45% respectively), and lower prevalence of caries (6% vs. 43%) (3,60).

Dental Sealants

Eight studies were identified that examined the retention of dental sealants in primary teeth. These studies show retention rates between 69 and 88% after one year with a one-time application (Table 4). These results suggest that retention in primary teeth may be superior to permanent teeth, possibly because most primary teeth are fully erupted at the time of sealant placement, whereas many permanent teeth are partially erupted when sealant application is usually performed.

Thus, there is insufficient evidence to determine the efficacy and cost-effectiveness of sealant placement on primary teeth. Although it might be reasonable to assume that such information could be extrapolated from permanent teeth, the pattern of caries in primary teeth is different. Primary molars are more susceptible to proximal lesions than permanent molars, making the sealant procedure in these cases of little consequence (63,64,69,70). Similar to permanent teeth, it is likely that caries risk assessment methods will need to be employed to make this preventive procedure cost effective (71).

Diet

The role of sugar in promoting the dental caries process has been derived from numerous epidemiological, laboratory and clinical studies. In preschool children, high frequency sugar consumption

(72) including its consumption by means of a baby bottles or sippy cups, has been implicated in early childhood caries. Epidemiological studies, however, show that sugar consumption is a risk indicator only in children who do not have regular exposure to fluoride (73). For those individuals at high risk for caries, prevention of excess sugar consumption and controlling of high frequency sugar consumption appear to be a reasonable component of a caries prevention program. Yet, there is presently no evidence demonstrating the effectiveness of dietary counseling on caries reduction in children.

In addition to controlling frequent sugar consumption, chewing gums with sugar substitutes such as saccharin, aspartame, sorbitol, mannitol or xylitol should reduce caries risk by stimulating salivary flow and decreasing mutans streptococci colonization. The outcomes of several clinical studies show that chewing xylitol containing gums reduces caries and ms levels (74).

Oral Hygiene

Poor oral hygiene is widely believed to be a contributor to caries activity. Thus, tooth brushing, flossing and professional tooth cleaning have long been considered a basic component of programs aimed at preventing dental caries. Yet, literature reviews on this topic have not found a relationship between dental plaque scores and dental caries prevalence, or between brushing with non-fluoridated toothpaste and dental caries prevalence (75). In young children, however, early visible plaque on the labial surfaces of the maxillary incisors is strongly associated with caries development (32). Furthermore, dental caries reductions have been noted in children who receive high frequency professional prophylaxis combined with some form of fluoride therapy (76) or frequent tooth brushing with fluoridated dentifrice (77). The specific contribution of the tooth cleaning procedure as part of these regimens remains unknown. Regular tooth brushing, nevertheless, should be encouraged, at least as a delivery system for the fluoride dentifrice (49).

Caries Risk and Preventive Therapies

Decisions for preventive therapies in primary teeth should be directed by an understanding of risk indicators for the child. Very often, there is little discrimination on the intensity and type of preventive therapies that are prescribed to diverse groups or individuals. Risk-based therapy assumes that there will be little benefit of preventive therapies for those children who are at low risk for dental caries. Conversely, children at high risk require intense prevention to primarily prevent caries initiation and secondarily to arrest caries progression (Table 5). Yet, at this time, there are no prospective studies that examine the success of applying different intensities of preventive programs to children stratified by caries risk.

RESTORATIVE THERAPY

Currently, the practice of dentistry primarily utilizes a surgical model of care. Restoration of teeth due to the caries still occupies substantial curriculum in dental schools and clinical time in dental practices. The collective manuscripts of this conference, however, suggest that dental care should be grounded in preventive services and supplemented by restorative therapy when indicated. Restorative therapy is a non-reversible procedure that makes a tooth susceptible to fracture and additional decay (78). This is particularly an issue in children, as longevity of restorations is less in the primary dentition than in the permanent dentition, and reduced in younger than in older children (79). However, restorative therapy is necessary to eliminate cavitations when dental plaque removal from the tooth is difficult, when there is a high level of caries not reversed by preventive therapies or when monitored white spots and small lesions show progression to cavitation. Additionally, restorations of teeth are essential where there is need to restore tooth integrity to prevent space loss or disease progression into the dental pulp.

Children at low risk may not need any restorative therapy. Children at moderate risk may require restoration of progressing and cavitated lesions, while white spot and enamel proximal lesions should be treated by preventive techniques and monitored for progression. Children at high risk, however, may require earlier restorative intervention of enamel proximal lesions, as well as intervention of progressing and cavitated lesions to minimize continual caries development. In such high-risk cases, more aggressive treatment of primary teeth with stainless steel crown restorations is better over time than multi-surface intracoronal restorations (80,81) (Table 5).

SUMMARY

The scientific basis for caries diagnosis, risk assessment, preventive and restorative therapy for primary teeth requires further development and continued validation. Most needed are longitudinal studies examining the integration of risk assessment with preventive therapies. Nevertheless, sufficient evidence exists to allow practitioners to transcend traditional surgical management of dental caries in primary teeth. Current information on the dynamic nature of the carious process and risk assessment allows increased emphasis on patient-specific approaches that include disease monitoring and prevention as well as restorative therapies.

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Figure: A concept of clinical decision making for caries management in primary teeth.

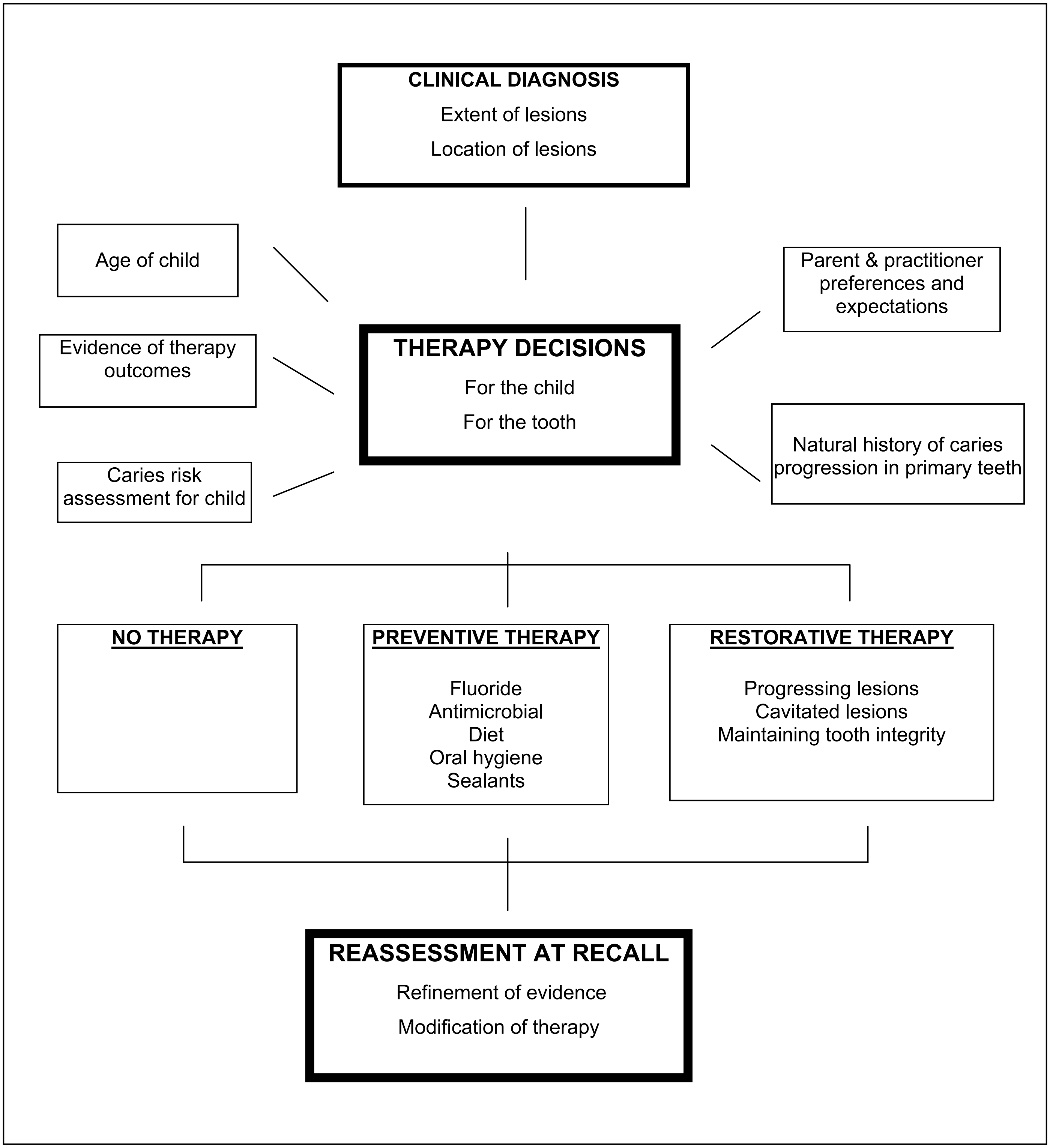

Table 1. Evidence for the rate of progression of proximal caries in primary teeth.

Year	Author	Country	Population/ Sampling method	N	Study length	Age at start	Control group	Treatment	Outcome
1978	Murray & Majid (10)	England	school children participating in a fluoride varnish study**r**	301 (retrospective study)	2 yrs	5yrs	Contra-lateral side but results combined	Fluoride varnish	Carious lesions only DX with BW at study beginning: 54% dx by BW only after 12mths 30% dx by BW only after 24 mths New carious lesions diagnosed at first year exam: 79% dx by BW only 51% dx by BW only after 12 mths 4% of inner enamel lesions still in enamel at 12 mths
1981	Craig et al. (11)	Australia	Preference given to young children with little or no previous dental care	94 pts at start 54 pts at finish	2 yrs	6-8 yrs	None	40%AgF and then 10%SnF to carious lesions, reapplied only if caries progressed.	First primary molar proximals: 81% still in enamel at 12 mths 81% still in enamel at 24 mths Second primary molar proximals: 72% still in enamel at 12 mths 69% still in enamel at 24 mths
1984	Shwartz et al. (12)	Sweden and US	Swedish: low F US: low F low SES	217 (retrospective study)	NR	Swedish: 10-11 yrs at end of study US: 4-17yrs at end of study	None	Swedish: Bi-weekly F rinse US: None	Sweden (Hi/Lo risk): 11/15mths to traverse outer enamel 15/25 months to traverse inner enamel US (Hi/Lo risk) 9/16 mths to traverse outer enamel 10/9 mths to traverse inner enamel
1992	Solanki & Sheiham (13)		Randomly selected pts from Murrary & Majid study	50 (retrospective study)	2 yrs	5yrs	Contra-lateral side but results combined	Fluoride varnish	Method 1: 73% of outer enamel lesions still in enamel at 12 mths 34% of inner enamel lesions still in enamel at 12 mths 60% of any enamel lesion still in enamel at 12 mths Method 2: 37% of enamel lesions still in enamel at 12 mths
1992	Peyron et al. (14)	Sweden	Subjects from a sugar study	468 (retrospective study)	2 yrs	3-4 yrs	Control and test groups combined.	Test group had sucrose replaced with invert sugar. Every other child in test and control had fluoride varnish.	78% of outer enamel lesions still in enamel at 12 mths 55% of outer enamel lesions still in enamel at 24 mths 29% of inner enamel lesions still in enamel at 12 mths

Table 2. Evidence for the validity of caries diagnostic methods in proximal and occlusal caries of primary teeth.

Year	Author	Country	Population/Sampling method	N	Age	Caries Diagnostic Criteria	Outcome
Occlusal caries							
1993	Ketley & Holt (16)	England	Teeth extracted under GA with questionable or minimal caries	100 second primary molars	NR	BW, in vitro clinical dx and histology	Sound/enamel caries on section: 100% dx as sound/enamel caries by visual 89% dx as sound/enamel caries by radiograph Dentin caries on section: 45% dx as dentin caries by visual 93% dx as dentin caries by radiograph
Proximal caries							
1992	Pitts & Rimmer (18)	Scotland	Private office pts	211 pts with 756 proximal surfaces with 380 lesions	5-15yrs	BW and tooth separation	Lesions clinically cavitated: 2% of lesions in outer half of enamel 3% of lesions in inner half of enamel 28% of lesions in outer half of dentin 96% of lesions in inner half of dentin (50% of any dentin lesions)
1996	De Araujo et al. (19)	Brazil	University clinic pts	20 pts with 320 proximal surfaces with 72 lesions	3-10yrs	BW and tooth separation	Lesions clinically cavitated: 6% of lesions in outer half of enamel (only 3 lesions were radiographically in inner enamel) 84% of lesions in dentin
1996	Nielsen et al (20)	Denmark	Exfoliated or extracted teeth	72 proximal surfaces with 43 lesions	NR	BW and in vitro clinical dx	Lesions clinically cavitated: 11% of lesions in outer half of enamel 14% of lesions in inner half of enamel 63% of lesions in dentin

Table 3. Evidence for use of fluoride varnish (FV) every 6 months among preschool children.

Year	Author	Study Length	Country	Population/ Sampling Method	N at start	Age at start	Control Group	BW at final examination	Dropout rate	Caries increment reduction
1979	Holm (51)	2 yrs.	Sweden	Randomly selected	250	3 yrs	Yes	Yes	10%	All caries:44%* Proximal: 42% Occlusal: 50%
1982	Grodzka et al. (52)	2 yrs.	Poland	9 schools received FV, 9 schools were controls	401	3 yrs	Yes	Yes	20%	All caries: <10%
1985	Clark et al. (53)	20 mnths	Canada	Randomly assigned volunteer school children	850	6 yrs.	Yes	No	19%	All caries: 9%
1998	Petersson et al. (54)	2 yrs	Sweden	12 public health clinics received FV, 12 were controls	5,137	4-5 yrs.	Yes	No	19%	All caries: 7% Proximal:16%*
1991	Frostell et al. (55)	2 yrs	Sweden	Children opting to not participate in dietary sugar study	206	4 yrs	Yes	Yes	NR	All caries:37%*
1996	Twetman et al. (56)	2 yrs.	Sweden	All pts of public dental clinics	837	4-5 yrs.	Yes	No	2%	All caries:30%* Proximal: 32%

FV -- Fluoride varnish applied in intervention group.

* Statistically significant difference in caries increment between FV and control groups

Table 4. Evidence for the retention of sealants on primary molars.

Year	Author	Study length	Country	Population/ Sampling method	Operator placing sealants	N	Age at start of study	Control group	Dropout rate	Outcome
1977	Alvesal et al (61)	2 yrs	Finland	Randomly selected children with pairs of intact teeth	Authors	163 pts at start 73 pts with 29 teeth available for follow-up at 2 yrs	6-7 yrs	Unsealed contra-lateral tooth	55% over 2 yrs (part of study had to be suspended)	1 yr results 67% sealants intact 30% partial or missing 3% caries 19% caries in unsealed group 2 yr results 45% sealants intact 41% partial or missing 14% caries 24% caries in unsealed group
1977	Charbeneau et al. (62)	18 mths	US	Volunteer school children with at least one pair of intact permanent first molars	NR	143 pts with 98 sealed teeth at start 80 teeth available for follow up at 18 mhts	5-8 yrs	unsealed contralaterals	18% over 18 mths	6 mth results 88% sealants intact 11% partially intact 0% sealant missing 1 yr results 73% sealants intact 24% partially intact 3% sealant missing 18 mths results 61% sealants intact 35% partially intact 4% sealant missing 1% had caries 9% caries in unsealed group
1979	Bagramian et al (63)	3 yrs	US	Volunteer school children	Trained staff dentists	600 pts	6 yrs	Yes, but results not reported in this paper	24% from sealant group	3 yr results: 61% sealant intact 19% resealed 20% carious (82% of carious teeth proximal caries)
1979	Cline & Messer (64)	6-18mths	US	Children attending university clinic requiring sealants	3rd and 4th yr dental students	182 pts	4-7 yrs	No	NR	76% sealants intact 13% partially intact 11% sealants missing
1981	Richardson et al (65)	2 yrs	Canada	Mentally retarded children	NR	160 pts	NR	Unsealed contra-lateral tooth	9% over 2 yrs	1 yr results 69% sealants intact 4% partially intact 27% sealant missing 2 yr results 46% sealants intact 5% partially intact 49% sealant missing
1986	Jones (66)	6mths-6yrs	US	All recall pts in 2 mth period at community dental health clinic	Dentists, hygenists, residents, dental students	256 pts with 302 sealed teeth	NR	No	NR	96% sealants intact 0.6% partially intact/missing 3% had caries (teeth were resealed as needed at recall apts)
1987	Hardison et al (67)	1 yr	US	Head Start children without treatment need. FU on a randomized subsample of centers	Trained dentists and hygienists (except one region had no training)	1562 surfaces	3-4 yrs	No	NA	1 yr results 88% sealant intact, 1% partially intact, 11% sealant missing
1998	Hotuman et al (68)	2-3.3 yrs	Denmark	Children attending community dental clinic with at least one pair of intact molars	Author	52 pts	3-4 yrs	Unsealed contra-lateral tooth	NR	72% sealants intact 16% partially intact 12% sealants missing Of these 7% had caries

Table 5: Possible diagnostic procedures, preventive and restorative therapy in primary teeth based on a child's caries risk assessment and age.

	Low Risk	Moderate Risk	High Risk
Caries Risk Indicators	dmfs < ½ child's age no new lesions in 1 year no white spot lesions low titers of mutans strep. high SES	dmfs >1/2 child's age 1 or more lesions in 1 year infrequent white spot lesions moderate titers of mutans strep. middle SES	dmfs > child's age 2 or more lesions in 1 year numerous white spot lesions high titers of mutans strep. low SES appliances in mouth high frequency sugar consumption
Diagnostic Procedures	examination interval 12-18 months radiograph interval 12-24 months initial mutans strep. evaluation	examination interval 6-12 months radiograph interval 12 months initial mutans strep. evaluation	examination interval 3-6 months radiograph interval 6-12 months mutans strep. testing to monitor compliance diet analysis
Preventive Therapy	fluoridated dentifrice	fluoridated dentifrice systemic fluoride supplements * professional topical fluorides tx sealants	fluoridated dentifrice systemic fluoride supplements * professional topical fluoride tx sealants daily home fluoride or antimicrobials dietary counseling and adjustments
Restorative Therapy	none	monitor white spot lesions monitor enamel proximal lesions restoration of progressing lesions restoration of cavitated lesions	monitor white spot lesions restoration of enamel proximal lesions restoration of progressing lesions restoration of cavitated lesions aggressive treatment to minimize continued caries progression

* age and water supply considerations